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Abstract

Mark-ups are often assumed to be constant for all firms within a sector in theoretical models. This paper reflects empirically on the distributions of companies mark-ups in order to test this assumption. We use exhaustive, Finnish company level micro-data to calculate the mark-up for each firm. The dataset covers 70 sectors from both the manufacturing and services sectors for the years 2005 to 2009. The wide variation of mark-ups found in some sectors suggests that assuming a constant mark-up estimate for all firms in the same sector is inappropriate. Our results indicate 16 out of 28 manufacturing and 31 out of 42 services sectors to support the heterogeneous mark-up assumption. We compare explicitly the mark-up distributions between companies of different size and exporting status. We find that small companies place on average higher mark-ups than large companies and domestic companies place higher mark-ups than exporting companies. Last, we characterize the sectors in which the assumption of homogenous mark-ups is to some extent justified. The results suggest that mark-up heterogeneity is greater in sectors with a low capital-labour ratio and high number of companies. Overall, mark-up heterogeneity is not prevalent only in few specific types of sectors, but seems like a wider phenomenon.

Key words: Mark-up, company heterogeneity, nonparametric methods

JEL classification numbers: L11, F23, C14

Tiivistelmä

Kaikkien yritysten oletetaan yleensä veloittavan samansuuruisen hintamarginaalin kullakin sektorilla teoreettisissa kansantaloustieteen malleissa. Tämä perustuu oletukseen samasta kysynnän hintajoustosta. Tässä tutkimuksessa testataan kyseistä oletusta tutkimalla empiirisesti hintamarginaalien jakautumia eri sektoreilla. Tutkimus pohjaa laajaan suomalaiseen yritystason mikrotietokantaan vuosilta 2005–2009. Kyseinen tietokanta sisältää havainnot 70:lle eri teollisuuden ja palvelualan sektorille. Havaittu, merkittävä variaatio

hintamarginaaleissa sektorien sisällä asettaa oletuksen homogeenisista hintamarginaaleista kyseenalaiseksi. Merkitsevää hintamarginaalien variaatiota havaitaan 16:lla yhteensä 28 tutkitusta teollisuussektorista ja 31:llä tutkitusta 42:sta palvelualan sektorista. Tutkimuksessa verrataan keskenään erisuuruisten ja eri vientistatuksen omaavien yritysten hintamarginaalien jakautumia kunkin sektorin sisällä. Tuloksien mukaan pienten yritysten hintamarginaalit ovat keskimäärin korkeampia kuin isojen yritysten. Kotimaiset yritykset pitävät samoin korkeampia marginaaleja kuin vientiyritykset. Jakautumien tutkimisen lisäksi kuvailemme, minkälaisilla sektoreilla löydetään merkittävää hintamarginaalien heterogeenisuutta. Regressiotuloksien mukaan hinta-marginaalit ovat heterogeenisempia sektoreilla, joilla pääoman suhde työvoimaan on alhainen tai joilla on suuri määrä yrityksiä. Hintamarginaalien heterogeenisuutta ei voida kuitenkaan identifioida vain tietyn tyyppisillä sektoreilla, vaan se näyttää olevan laaja-alaisempi ilmiö.

Asiasanat: Hintamarginaali, yritysten heterogeenisuus, ei-parametriset metodit

JEL-luokittelu: L11, F23, C14

Contents

1. Introduction

Heterogeneity in general brings variety to life, but for policy makers large heterogeneity among people or companies means mostly difficulties. During the past decade international economists have found evidence that companies within a sector can have significantly different production structures, productivity levels and salary levels (Wagner, 2011). Exporters and large companies are often found to have higher productivity levels than domestic companies and small companies (Mayer and Ottaviano, 2008). According to Wagner (2011) the differences in productivity levels between exporters and non-exporters within a sector are the largest in countries with low export participation rates, restrictive trade policies, low GDP per capita and ineffective regulatory environment. In short, firm heterogeneity seems to be the largest in developing countries.

In this paper, we study the heterogeneity of mark-ups within various manufacturing and services sectors. We have two main reasons for the focus on mark-ups. First, mark-ups measure market power (Konings et al., 2001, 2005; Chen et al., 2009; Abraham et al, 2009; Antonio and Omar, 2011). Economists and policy makers alike are interested in assessing the degree of competition in a market and the effects of various industrial and trade liberalization policies on market power. In industrial organization studies, the wide variation of mark-up between industries has long been recognized. The use of mark-ups for market power assessment is based on the typical textbook partial-equilibrium analysis suggesting that price should equal variable cost in a perfectly competitive market setting. Deviations from this equality signal market distortions. In general, these distortions arise from specific firm level factors and also from other factors external to the firms (Ponikvar and Tajnikar, 2011). Productivity differences and strategic pricing are examples of firm level specific factors (Martin, 2001; Sutton, 2001; Dunn, 2002). External factors include industry specific factors and factors that relate to the general macroeconomics conditions (Martin, 2001; Andreosso and Jacobson, 2005; Pepall et al, 2008). Overall, great mark-up dispersion within narrowly defined sectors would imply high variety in the level of market power between companies.

Second, mark-ups are directly linked to demand elasticities in monopolistic competition models and are hence a fundamental ingredient embedded in economic models. The new trade (Krugman, 1980; Ethier, 1981), new economic geography (Krugman, 1991) and heterogeneity literature (Melitz, 2003; Helpman et al., 2004; Yeaple, 2005; Helpman, 2006 are some examples) often base their theoretical and empirical work on the Dixit and Stigliz (1977) framework. This framework assumes that each company places an exogenously fixed mark-up over the production costs. Other studies model with endogenously determined mark-ups instead. This is done either by adapting the Ricardian model with firm specific comparative advantage (Bernard et al., 2000) or by using the linear

demand system with horizontal product differentiation (Ottaviano et al., 2002). Endogenous mark-up literature has had fewer followers, but has recently gained more interest (Melitz and Ottaviano, 2008). From the modelling point of view, empirical findings of great mark-up heterogeneity within a sector would suggest the necessity to model with an endogenous mark-up assumption. Findings of homogenous mark-ups would in contrast support the common practice of modelling with exogenous mark-ups.

Recent studies analyse the effects of trade liberation on mark-up distributions theoretically (Epifani and Gancia, 2011) and the determinants of mark-up distribution (Ponikvar and Tajnkar, 2011 for Slovenian manufacturers'). Their main results show that the determinant factors for mark-ups heterogeneity, such as market share, expansion plan, production capacity utilization and labour productivity, vary across sectors. Empirical studies related to efficiency wage theorem have found also evidence on large differences in wages and rent sharing within industries (e.g. Krueger and Summers, 1988), which can affect mark-up distributions. Earlier studies suggested that the revealed differences in average sector level mark-ups can be explained by trade openness, union power, market concentration, capital intensity, technology level and level of sunk R&D investment required[1]. We expect some of the same factors to be at work in explaining the mark-up variation within each sector.

In general, most empirical studies on mark-ups cover only larger companies in the samples and companies from manufacturing sectors (Lima and Resende, 2004; Feeny et al., 2005; Chen et al., 2009; Epifani and Gancia, 2011). To the contrary, the database we apply consists of exhaustive company level micro-data from the tax statistics covering the whole population of registered firms in Finland. Like in most developed countries, the underground economy in Finland is minimal. Therefore the dataset we use provides an opportunity to study all economic activities both in the manufacturing sector and services sectors, and for firms of all size.

As mentioned earlier, the purpose of this research is to provide a better understanding on the extent of mark-up heterogeneity within sectors. We argue that if significant mark-up heterogeneity is found in Finland, it is very likely that the extent of mark-up heterogeneity is even greater in less developed countries (Wagner, 2011). It is frequently observed that technology and capital intensity levels adopted by companies in less developed countries differ significantly. For example, labour intensive farming and (foreign owned) technology intensive plantation often coexist in countries like Brazil, India and Mexico. In addition,

[1] Explanations for markup heterogeneity: trade openness (Chen et al., 2009; Epifani and Gancia, 2011), union power (Abraham et al, 2009), market concentration (Machin and Van Reenen, 1993; McDonald, 1999; Lima and Resende, 2004), capital intensity (Feeny et al., 2005; Ponikvar and Tajnikar, 2011), technology level and level of sunk R&D investment required (Konings et al, 2001).

less concentrated markets, limited or restricted trading opportunities and unequal provision of infrastructure across regions in less developed countries can limit the competition intensity between companies and result in greater observed mark-up heterogeneity. As Finland is a country with relatively high export participation rate (Annex 1[2]), open (EU) trade policies, high GDP per capita and effective regulatory system (World Bank, 2012 DBI), the mark-up heterogeneity found based on Finnish data should be considered to reveal the minimum mark-up variation to be expected in an economy.

In this paper, we extend the literature in three ways with our exploratory empirical analyses. First, we analyse the extent of mark-up heterogeneity within 70 Finnish sectors and examine whether the data supports modelling with an exogenous or endogenous mark-up assumption. We analyse mark-up heterogeneity from two perspectives: 1) how much mark-ups vary in general within narrowly defined sectors and 2) are there systematic differences in the mark-up distributions between different types of companies. In this first part, non-parametric tests are applied to analyse the variation and equality of the mark-up distributions between different types of companies in each sector. Non-parametric tests allow us to analyse the whole mark-up distributions instead of comparing only the means or quartiles. Second, we characterize the factors that correlate with the degree of mark-up variation. In this second part we use regression analyses to identify sector characteristics that correlate with the degree of mark-up heterogeneity. This also allows us to control for various factors that could affect our non-parametric results. Third, we contribute to the literature by conducting the analyses with an exhaustive dataset that covers all companies in the Finish economy, including both manufacturing and services sectors and firms of all size.

The next section presents our methodology. The Finnish company level database used to calculate the mark-ups is described in section three. Section four reports the empirical findings on mark-up heterogeneity within sectors, based on non-parametric distribution tests, and the parametric regressions results. The final section includes the conclusions.

[2] All annexes (1-3) are published in the working paper version that is available online. They can also be obtained upon quest.

2. Methodology

2.1 Calculations of mark-ups

A large amount of literature has been devoted to the development of techniques to calculate unbiased mark-up estimates. The production function framework developed by Hall (1988) induced a stream of empirical research[3] with modified approaches to estimate mark-ups from production data. The estimations based on the production function framework rely on detailed price and quantity information and on data covering various input costs, which are often unavailable at company level. In addition, the estimations provide only information on the average mark-ups per sector or per company type instead of information on the distributions. They also often suffer from endogeneity problems due to unobserved factors in the specification that have an impact on the output growth. Accurate calculations of services sector outputs would be a challenge as well and they have mostly been neglected so far. As the focus of this paper is not on methodology improvement, we apply a straightforward definition of mark-up to insure result tractability. We argue that with sufficiently detailed data on companies' cost structures, this simple method can provide an adequate approximation of mark-up heterogeneity within sectors.

Our empirical approach is based on two fundamental equations, namely the firm's profit function and the equation that links price with variable cost. Based on cost accounting, the cost function is defined to include two main parts: fixed and variable costs, of which only the latter is changing proportionate to the output quantity produced. Firm profits are equal to the difference between revenue from sales and total costs, as defined in equation 1. The total revenue is equal to the product of unit price and quantity sold. The last equality again shows that the total variable cost is equal to the product of per unit variable cost and quantity sold. We denote profit of firm $i \in I_j$ in sector $j \in J$ as π_{ij} , sales as S_{ij}, total costs as TC_{ij}, price as p_{ij}, quantity sold as x_{ij}, total fixed and variable cost as F_{ij} and V_{ij}, and per unit variable costs as c_{ij}. Notice that the per unit variable costs here represents the firms' constant input investment for production of one unit of output, which is relatively stable in the short-run. The relationship between the price and variable costs for each unit of output is as in equation 2. It shows that each firm charges a mark-up rate $1+\mu_{ij}$ over its variable costs c_{ij}.

$$(1)\quad \pi_{ij} = S_{ij} - TC_{ij} = p_{ij}x_{ij} - (c_{ij}x_{ij} + F_{ij}) = p_{ij}x_{ij} - (V_{ij} + F_{ij})$$

$$(2)\quad p_{ij} = (1+\mu_{ij})c_{ij}$$

[3] See Levinsohn (1993), Harrison (1994), Roeger (1995), Konings and Vandenbussche (2005); Moreno and Rodriquez (2010), De Loecker and Warzynski (forthcoming).

The main problem faced in empirical estimations of mark-ups is that we often do not observe the quantities individual firms produce, nor the individual unit prices or the per unit variable costs c_{ij} a firm bears. We define mark-up μ_{ij} as the difference between product price and unit variable cost relative to the unit variable cost (equation 3). By multiplying both the denominator and nominator by the quantity produced, empirical estimation difficulties can be overcome with the availability of information on the aggregated sales and total variable costs. This information combined is sufficient to calculate the key variable of interest: the company specific mark-ups.

$$(3)\quad \mu_{ij} = \frac{p_{ij} - c_{ij}}{c_{ij}} = \frac{p_{ij} - c_{ij}}{c_{ij}} \frac{x_{ij}}{x_{ij}} = \frac{S_{ij} - V_{ij}}{V_{ij}} = \frac{\pi_{ij} + F_{ij}}{V_{ij}}$$

Bresnahan (1987) noticed that there is no stable connection between companies reported annual profits and their actual mark-up. This observation is rectified with our methodology since the mark-up estimates include fixed costs within the mark-up ratio and all the companies within narrowly defined sectors can be assumed to face the same business cycle.

2.2 Methodology for the analysis of distributions

For the analyses of mark-up distributions, we use non-parametric methods. Firstly, we measure the general variation of the company specific mark-ups with coefficients of variations (CV_{jt}) in each sector $j \in J$ at time $t \in T$. Coefficient of variation is a normalized and dimensionless measure on the dispersion of a distribution. It is not affected by large differences in the mean levels of mark-ups or by standard deviations that increase proportionate to the level of the mean.

Second, we analyse whether the mark-up distributions of different types of companies within each sector are significantly different from each other. We use Kolmogorov-Smirnov (K-S) tests to measure whether there are significant differences in the mark-up distributions of different types of companies. In addition, Welch's t-tests, cumulative probability function analyses and Kruskal-Wallis (KW) equality-of-populations non-parametric test are used to analyse whether either of the distributions in the comparison pair stochastically dominates the other. Welch's t-tests are used in sectors with high levels of observations for all different company type categories. The other tests are used next to the K-S tests in sectors with few observations.[4] According to the central

[4] Since the K-S tests are already sensitive to both the location and to the shape of the distributions, the KW tests do not report significant differences in the medians at any time when the K-S test reports no significant difference in the distributions. Hence, the KW test results are not explicitly reported.

limit theorem, t-tests provide valid results even if the distributions tested are non-normal, as long as the number of observations is sufficiently high[5].

In the K-S tests, under the null hypothesis the two samples are from the same underlying distribution, i.e the mark-ups can be assumed homogenous. These non-parametric methodologies for distributions analyses were used also by Delgado et al (2002). To perform the K-S test, the observations in different groups should be independent. Therefore we perform these tests for each year separately and use the average of the five yearly p-values to reflect whether the homogeneity assumption is rejected at most years or not. The t-tests are done with pooled data (see section 3).

2.3 Methodology for the regression analyses

As mentioned in the introduction, especially for empirical and theoretical model developers it is not only relevant to know whether the mark-ups (and demand elasticities) are heterogeneous within sectors, but also to see in what types of sectors heterogeneity is found. In case some specific sector characteristics can be concluded to correlate with heterogeneous mark-ups, it will be easier to account for them. With regression analyses we can also control for possible measurement errors related to our mark-up calculation methodology. These are discussed in detail in section 3.1.

The regression analyses are done with two main specifications. In the first one we analyse in what type of sectors mark-ups vary the most in general. In this regression, the coefficients of variation (CV_{jt}) are regressed on various control variables (X_{jt}) using random effects panel regression with robust standard errors (equation 4). The selection of random effects is based on Hausman-test statistics. The control variables include average export share in turnover, log of capital-labour ratio, average size of companies in terms of employees, total number of companies, Herfindahl index on concentration, average share of management level employees, and average share of tradable stocks in the total value of equity. Summary statistics for these variables can be found in Annex 3.

$$(4)\ CV_{jt} = X'_{jt}\beta + \varepsilon$$

In the second regression we perform panel probit regressions with random effects on the K-S test results on mark-up distributions similarity. We base these regressions on the p-values of the non-parametric K-S distribution tests of each sector at each year (equation 5). The dependent variable is one if the K-S test result suggests the two distributions to have significantly different underlying distributions. We perform separate regressions on the probability of finding heterogeneous mark-ups between companies of different size and on the

[5] Usually around 80 observations per type is considered enough (Ratcliffe, 1968).

probability of finding heterogeneous mark-ups between domestic and exporting companies (see section 3 for further information on these groupings). In addition to the control variables mentioned earlier, these regressions include the mark-ups' coefficients of variation as a control variable in order to measure the correlation between our two mark-up heterogeneity measures.

(5) $Y_{jt} = X'_{jt}\beta + \varepsilon$, where

$\mathrm{Y} = 1, \text{if p} - \text{value on markup distributions similarity} \leq 0.05,$

$Y = 0, \text{otherwise}.$

3. Data

The analyses are based on an exhaustive company level micro database from Finland. The database is compiled from the tax forms sent to the public authorities and hence it includes all companies operating in Finland from all sectors. This study analyses the data from year 2005 until 2009. For this period the data includes information on each company's export status.

The database contains large amounts of data for each company at very detailed levels[6] and provides an ideal source of information for the analyses of mark-ups at the company level. The number of companies included in the database is between 200,000 and 250,000 per year. The companies are classified into four size categories according to the official EU classification[7]. Self-employed are not included in the sample of this study. The data has been carefully checked for errors and some unreliable seeming observations were dropped completely from the analysis.[8]

In addition to the main database, the Value Added Tax (VAT) records are used for the identification of exporters. The procedure for the identification of each company's exporting status is explained in detail in Annex 1. The database also allows the identification of multinational companies. Since there are only a few multinationals operating in most of the sectors at each year, we include only the comparison of mark-up distributions by size categories and by export status in the analyses. These two dimensions provide relatively straightforward ways to group companies and allow us to compare our results to earlier studies in which these categories have been used extensively (Mayer and Ottaviano, 2008, Wagner, 2011).

The companies are grouped to 70 sectors (see tables 2 and 3), which correspond roughly to NACE 2-3 digit classifications. These sectors include the most important activities in the Finnish economy[9]. The sectors are disaggregated to as low NACE levels as possible in order to group only companies with relatively similar production structures and end products together. In more aggregated levels, the companies are too heterogeneous for a meaningful analysis of within

[6] Including e.g.: the legal form of the company, main sector of business, location (city and region), all financial accounts information (total revenue, profit/loss of the accounting period, salary costs, intermediate product costs, depreciations and amortizations, chanced in assets values, financing costs and various other detailed cost categories) and all balance sheet information (values of different types of capital assets, own capital, debt, etc.)

[7] http://europa.eu/legislation_summaries/enterprise/business_environment/n26026_en.htm. The four categories are: micro, small, medium and large companies. Micro companies have less than 10 employees, small 10-49 employees, medium 50-249 employees and large over 250 employees.

[8] This included around 4,000 observations out of the total 1.15 million observations.

[9] We exclude only mostly not-for-profit sectors. Full list of sectors available from the data and the sectors not included in the study can be obtained by request.

sector heterogeneity. Unfortunately, the number of observations per year is relatively low in some sectors at such disaggregated level. Therefore, we have pooled the observations of each sector from all the five years under study for the non-parametric distribution analyses (except for K-S tests). This way, the possible yearly fluctuations caused by business cycles in the mark-ups are balanced away. It should be also noted that mark-ups calculated according to our specification are not affected by inflation.

Table 1 shows the number of observations included in the total database versus the used subsample of companies, for which export status could be identified. One observation accounts for one company during one year. As the data for very small companies with 0-3 employees is less reliable[10] compared to the data for larger companies, these companies were dropped from the main analysis. This decision was tested not to affect the main results, but it did bring down the variances of all indicators for micro-sized companies. The number of employees in the sample used covers around 66-69 percent of total employment[11] in Finland.

Table 1 Number of observations in the database and used sample, all sectors, 2005-2009

	All data	VAT records, i.e. with identifiable export status
All companies	1,155,910	715,390
Used sample in total (companies with minimum 4 employees), of which:	287,850	266,640*
-Micro companies (4-9 employees)	147,250	136,170*
-Small companies (10-49 employees)	115,800	107,410*
-Medium sized companies (50-249 employees)	20,190	18,870*
-Large companies (more than 240 employees)	4,600	4,200*

* Indicates the observations used in the research and their breakdown to each size category.

3.1 Calculation of variable and fixed costs

In order to calculate the mark-ups, information on company specific fixed costs is required. We calculate first the total costs of each company after which the costs are split into two parts, the variable costs and fixed costs. This division is based on the assumption that only variable costs vary proportionately to the level of output within a period of one year − the standard reporting period in Finland. The following specifications on total costs and variable costs were made in line with the Finnish and international accounting specifications:

[10] As an example, the coefficient of variation in mark-ups for micro-size companies is 6.1 if all companies reporting non-zero variable costs are included in the sample and 2.6 if companies with 0-3 employees are dropped.

[11] Based on total number of 15-74 year old workforce in Finland between 2005-09 (Statistics Finland).

- Total costs = all revenues – profits (or + losses);
- Variable costs: salary costs, intermediate input costs (goods), changes in stocks, outside services costs, incidental expenses, representation costs, and leasing costs and office rents[12]; and
- Fixed costs = total costs – variable costs

Fixed costs calculated this way consist mainly of depreciations, changes in capital assets values and interest payments on loans. Recognising that especially asset value fluctuations can impact the fixed costs heavily in public limited companies (whose shares are traded in the stock markets), we control for this potential source of variation in the regression analyses by taking into account the average value of stock assets in all equity. The shares of labour costs and intermediate input costs that could be considered as fixed costs differ also between companies, depending on their organisational structures. While we cannot correct for these potential sources of measurement error in the non-parametric tests, we can control for them in the regression analyses that try to explain the source of the within sector mark-up heterogeneities. In practise, we use data from the national accounts of Statistics Finland on the share of employees at management level positions[13] out of the total number of employees at each sector to control for the potential fixed labour costs.

3.2 Test of data and methodology

Since we can use only data from one country for the analyses, we test first if there are any major differences between the Finnish sample we use and the samples used in earlier studies (from other countries). First, comparisons of the average salary distributions of small versus large companies reveal that larger companies in Finland pay significantly higher wages than smaller companies in the same sector. Similarly, larger companies and exporting companies report higher productivity levels (both in terms of sales per employee and value added per employee) compared to small and domestic companies, respectively. These results are in line with the wage and productivity premiums of exporters found in other studies (e.g. Mayer and Ottaviano, 2008, Wagner, 2011). See Annex 2, table A2.1, for sector specific results on the average salary and productivity levels between different types of companies.

Second, we calculated average mark-up estimates for all the 70 sectors (see Annex 2, table A2.1). In line with previous studies on company heterogeneity (Wagner, 2011), the average mark-ups are calculated after dropping the first and

[12] Some of the leasing and rental costs might be in practice fixed costs. However, most leasing and office rental agreements in Finland are nowadays made for relatively short time periods or can be terminated on few months notice. Leasing costs are, again, mostly based on actual consumption. Therefore these costs are expected to vary according to the level of output.

[13] This includes employees under group 1 of the 10 main occupation groups used by Statistics Finland.

last one percentile of outlier observations in each sector.[14] These average mark-ups were checked to approximately match the 50th percentile of the cumulative probability function drawn from all the observations within each sector. In general, the average mark-up in manufacturing sectors is around 0.56 and around 0.8 in services sectors. These results correspond well to findings in earlier studies (e.g. Molnar and Bottini, 2008[15]).

[14] In most of the sectors, these top outliers affect the calculation of the means significantly and hence they are usually dropped. As an example, if the outliers are included in the sample, the mean mark-ups in financial services (IND 65) and in activities auxiliary to financial services (IND 671) are 3.3 and 3.1, with standard deviations of 9.9 and 22.6, respectively. When the top outliers are dropped, the same means are 1.2 and 1.03, with standard deviation of 1.3 and 1.1, respectively.

[15] Molnar and Bottini (2008) based their research on the Amadeus database with observations for Finland from years 1996-2006 with limit on companies with minimum 20 employees. Average mark-ups calculated in this paper match well with theirs when we use the same limit on company size.

4. Results

We present first in section 4.1 the extent of mark-up variation per sector together with the results on the similarity of the mark-up distributions between different types of companies. We show first a couple of examples on mark-up distributions for different types of companies and after that present the main results for 28 manufacturing and 42 services sectors in sections 4.1.1 and 4.1.2, respectively. Section 4.2 continues by presenting the regression results. They show 1) in what type of sectors mark-ups vary the most and 2) in what type of sectors significant differences are found in the mark-up distributions of different types of companies.

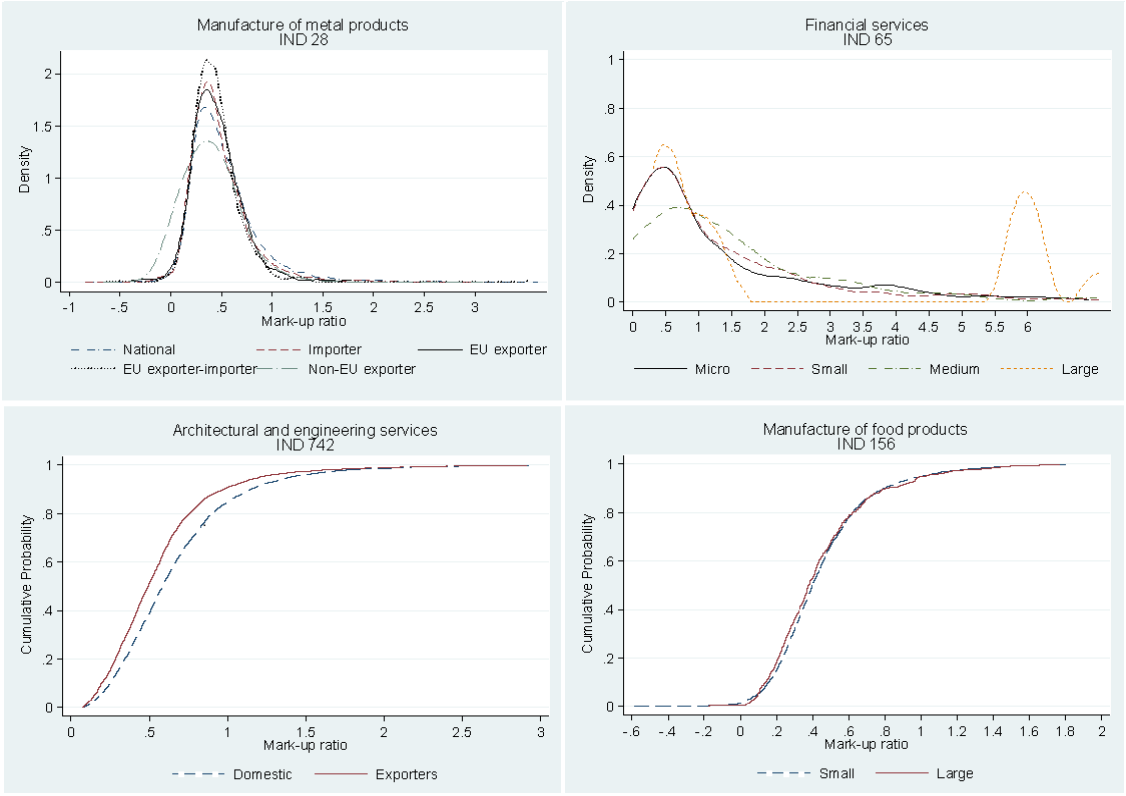
4.1 The extent of mark-up heterogeneity per sector

Mark-ups seem to vary significantly between sectors and within sectors in Finland. The standard deviation of average sector level mark-ups is around 0.3, while mark-ups within sectors have a mean standard deviation of 0.6 when outliers are dropped (Annex 2, table A2.1).

Figure 1 provides a first picture on the variation of mark-ups within few sectors in general and between different types of companies. The graphs show that cumulative probability functions of mark-ups distributions depict the clearest pictures for the comparison of different types of companies' mark-up distributions[16] (lower graphs in figure 1) as compared to the kernel density curves (upper graphs in figure 1). For example, domestic companies' mark-up distribution stochastically dominates exporting companies' mark-up distribution in architectural and engineering services. In manufacture of food products sector, no significant differences are found. Kernel density curves, again, are more useful in depicting various distribution patterns. The graphs illustrate especially that mark-ups' variation and the mark-up distributions of different company types differ per sector. Consequently, we apply the K-S tests to reflect whether the distributions of different types of companies within each sector have the same underlying distribution.

[16] Only the top and bottom last percent of observations has been cut for each graph.

Figure 1 *Examples of Kernel density functions and cumulative probability functions of mark-ups in different company categories*



Numbers of observations: Manufacture of metal products: around 3,800 domestic, 1,700 importing, 450 EU exporter, 800 EU exporter-importer and 2,750 Non-EU exporter obs. Financial services: around 450 micro, 430 small, 100 medium and 30 large companies obs. Architectural and engineering services: 6100 domestic (incl. importers) and 2600 exporter obs. Manufacture of food products: 3000 small (micro and small) and 600 large (medium and large) observations.

Tables 2 and 3 report the coefficients of variation and the results from the distributions similarity tests (K-S tests) for all manufacturing and services sectors, respectively.[17] We compare the differences in the distributions for three comparison pairs, namely the differences in the mark-up distributions of:

1. Small companies[18] vs. large companies in 69 sectors,
2. Small domestic companies vs. small exporting companies in 47 sectors; and
3. Large domestic companies vs. large exporting companies in 47 sectors.

[17] In the analyses we drop the observations where no variable costs are reported due to their overshooting problem (according to our specification, mark-up will approach indefinite if variable costs are zero). Otherwise, the distribution analyses include also outliers.

[18] The small category includes micro and small companies and large category includes medium sized and large companies as categorized by the EU classification mentioned earlier.

The exporting status is analysed individually for companies of different size in order to differentiate the possible size effect on mark-ups from the export effect. Due to the limited possibilities to identify exporters in the services sectors, the comparisons of small versus large companies could be performed in more sectors than the comparisons based on the export status.

Based on the K-S tests, in 57 percent of (16 out of 28) manufacturing sectors and in 73 percent of (31 out of 42) services sectors significant differences are found in the mark-up distributions within the sectors. Tables 2 and 3 show in the top parts 2.A and 3.A in detail the sectors in which significant heterogeneity is found. The null hypothesis of homogenous mark-ups is rejected at 5 percent significance level (p-value ≤ 0.05). Annex 2, table A2.2 includes the detailed results for each sector. In 38 out of 69 cases, significant differences are found in the mark-ups of small companies versus large companies. Similarly, in 21 out of 47 sectors, companies with different export status have significantly different mark-up distributions. These results hold, even when they are double checked with fixed effects panel regressions where all possible exporter and size dummies are included.

The coefficients of variations are also above 1 in many sectors, which suggests great mark-up variation within the sectors. Nevertheless, the connection between the coefficients of variations and the K-S test results is not straightforward. In sectors with low dispersion of mark-ups (i.e. relatively low CV), significant differences exist still between different types of companies. Similarly, large general variation does not mean that the mark-up distributions of different types of companies would differ systematically.

4.1.1 Results for manufacturing sectors

Table 2 presents the p-values of the K-S tests and coefficients of variation in detail for each manufacturing sector. Consequently, it provides a first glance on the type of sectors where significant mark-up heterogeneity is found. In 12 out of total 27 manufacturing sectors, significant differences are found in the mark-up distributions of small companies versus large companies. Out of these 12 sectors with significant test statistics, in 11 sectors smaller companies are found to have on average higher mark-ups than larger companies based on the t-tests and KW-tests, with the exception of sector 4013 (distribution of electricity and gas). Similarly, in all the 11 sectors where small domestic companies and small exporters' mark-up distributions differ, the domestic companies report significantly higher average mark-ups. The lack of significant results in the mark-up distribution analyses of large domestic companies versus large exporting companies seem to result from the low numbers of observations in both of these categories. Even so, the only significant sector, the manufacturing of metal products sector, shows that the large domestic companies have on average higher mark-ups than large exporting companies in that sector (Annex 2 Table A2.2)..

De Loecker and Warzynski (forthcoming) found also indications of mark-up heterogeneity within sectors. Contrary to our result, they found that exporters apply higher mark-ups than non-exporters in the manufacturing sectors. This difference in the result could result from differences in the samples used in terms of company-size limit. It should be also noted that Ropponen (2012) reports that the Finnish tax systems does encourage micro-sized companies owners to take part of their own salary from the profits of the company (that have lower effective taxes than salaries). The effect of this incentive problem is not clear, though, when there are more than 4 employees in the company. For this reason, we will control for the average size of companies later in our regression analyses.

Table 2 Mark-up distributions coefficient of variation (CV) and p-values of similarity tests, manufacturing sectors

Sector code	Manufacturing sectors	P-value on distributions similarity			CV
		Large vs. small	Small, domestic vs. exporter	Large, domestic vs. exporter	All companies
A. Sectors with significant differences in at least one comparison pair					
2	Forestry and logging	0.01	0.01	0.15	0.78
20	Manufacture of wood and wood products	0.00	0.00	0.14	1.04
22	Publishing and printing	0.00	0.00	0.39	0.90
25	Manufacture of rubber and plastic	0.00	0.00	0.12	0.87
26	Manufacture of glass and ceramic	0.00	0.08	0.08	0.82
28	Manufacture of metal products	0.00	0.00	0.02	0.79
29	Manufacture of machinery	0.00	0.00	0.40	0.88
32	Manufacture of electronics	0.05	0.30	0.69	1.06
33	Manufacture of medical, testing and optical equipment	0.00	0.00	0.28	0.85
134	Mining of non-ferrous metals	0.51	0.00	0.11	0.97
179	Manufacture of textiles, wearing apparel and shoes	0.37	0.00	0.35	0.75
345	Manufacture of cars and other transport equipment	0.00	0.20	0.60	1.02
2725	Manufacture of processed iron and steel	0.86	0.00	0.07	0.65
3626	Manufacture of jewellery, music instruments and toys	0.16	0.00	0.81	0.95
4013	Distribution of electricity and gas	0.04	0.91	0.74	1.15
21121	Manufacture of pulp, paper and paperboard	0.00	0.51	0.29	0.83
B. Sectors with no significant differences in any comparison pair					
1	Agricultural production	0.20	0.39	0.86	0.94
5	Fishing and fish farming	n.a	0.25	n.a	1.05
23	Manufacture of coke and refined petroleum	0.56	n.a	n.a	0.65
24	Manufacture of chemicals	0.13	0.38	0.87	1.02
37	Recycling of metal and non-metal waste	0.32	n.a	n.a	0.76
41	Distribution of water	0.51	0.53	0.39	0.79
103	Extraction and agglomeration of peat	0.77	0.48	n.a	0.82
156	Manufacture of food products and beverages	0.95	0.07	0.10	0.78
212	Manufacture of paper and paperboard	0.29	0.11	0.11	0.63
271	Manufacture of iron and steel	0.70	0.79	0.20	1.19
301	Manufacture of office and electrical equipment	0.22	0.59	0.25	0.96
361	Manufacture of furniture	0.25	0.41	0.23	0.77
Total number of sectors with significant* heterogeneity		12	11	1	
Total number of sectors tested		27	26	24	28
Percentage of sectors with significant heterogeneity		44%	42%	4.2%	

* Significant heterogeneity is concluded to occur in sectors with K-S p-values smaller or equal to 0.05.

4.1.2 Results for services sectors

The results for the services sectors presented in table 3 are very similar to the results for manufacturing sectors. In 26 out of the 42 analysed sectors, significant differences are found between small companies and large companies' mark-up distributions. Out of the 26 sectors, 24 sectors show that smaller companies have a higher mark-up than larger companies and in two sectors larger companies report higher mark-ups (sectors 61 and 642). In the comparisons by export status, small domestic companies report again higher mark-ups than small exporting companies. The large exporting companies in contrast are found to have significantly higher mark-ups than large domestic companies (sectors 72 and 748). These results are congruent to our expectations. Exporters face often stronger market competition than domestic companies, especially in services sectors with low imports and foreign companies' access possibility.

Table 3 *Mark-up distributions variability and p-values of similarity tests, services sectors*

Sector code	Services sectors	P-value on distributions similarity			CV
		Large vs. small	Small, domestic vs. exporter	Large, domestic vs. exporter	All companies
A. Sectors with significant differences in at least one comparison pair					
51	Wholesale trade and commission trade	0.00	n.a	n.a	1.21
61	Water transport	0.01	n.a	n.a	0.93
72	Computer and related services	0.93	0.88	0.02	0.92
73	Research and development	0.27	0.05	0.76	1.36
80	Education	0.00	n.a	n.a	0.72
501	Sale of motor vehicles	0.00	n.a	n.a	2.20
502	Maintenance and repair of motor vehicles	0.00	n.a	n.a	0.98
521	Retail sale	0.00	n.a	n.a	1.07
527	Repair of household goods	0.41	0.00	n.a	0.70
633	Other transport and travel services	0.02	0.00	0.58	1.18
641	Post and courier activities	0.00	0.25	0.09	0.79
642	Telecommunications	0.04	0.06	0.10	1.04
671	Activities auxiliary to financial intermediation	0.63	0.00	0.61	1.10
741	Legal, accounting, book-keeping and auditing services	0.00	0.19	0.87	0.82
742	Architectural and engineering activities	0.00	0.00	0.52	0.78
743	Technical testing and analysis services	0.52	0.02	0.89	0.73
744	Advertising services	0.00	0.00	0.07	0.79
745	Job agencies and personnel recruitment	0.00	0.07	0.10	1.11
746	Security services	0.00	0.45	0.62	0.96
747	Cleaning services	0.00	0.01	0.96	0.93
748	Other business services	0.00	0.00	0.02	0.96

851	Human health services	0.00	n.a	n.a	0.79
853	Social work services	0.00	n.a	n.a	0.86
4501	Construction of buildings	0.00	n.a	n.a	0.83
4502	Civil engineering	0.00	n.a	n.a	0.98
4509	Construction service activities	0.00	n.a	n.a	0.86
6023	Road transportation services	0.00	n.a	n.a	0.93
7032	Management of real estate	0.00	n.a	n.a	0.77
9214	Entertainment and news services	0.00	0.20	0.60	0.94
9267	Sports and other recreational services	0.00	n.a	n.a	0.75
63019	Road, track and air transport service activities	0.00	n.a	n.a	1.14
B. Sectors with no significant differences in any comparison pair					
62	Air transport	0.26	0.61	0.46	0.99
65	Financial services	0.17	0.60	0.15	1.10
66	Insurance services	0.78	n.a	n.a	1.05
71	Renting of machinery and equipment	0.46	0.29	0.96	0.91
90	Environmental services	0.16	0.58	0.83	0.80
551	Hotels	0.37	n.a	n.a	0.78
553	Restaurants	0.43	n.a	n.a	0.66
601	Transport via railways	0.72	n.a	n.a	1.05
672	Activities auxiliary to insurance services	0.48	0.47	n.a	0.79
7012	Real estate activities	0.20	n.a	n.a	1.03
7031	Real estate agencies	0.45	n.a	n.a	0.67
Total number of sectors with significant heterogeneity		26	9	2	
Total number of sectors tested		42	21	19	42
Percentage of sectors with significant heterogeneity		62%	43%	11%	

* Significant heterogeneity is concluded to occur in sectors with K-S p-values smaller or equal to 0.05.

To summarize, significant differences in the mark-up distributions of different types of companies are found in over half of the sectors, more in the services than in the manufacturing sectors. In the sectors where significant differences are found, small companies place on average higher mark-ups than large companies and domestic companies place higher mark-ups than exporting companies. The sector level coefficients of variation show that mark-ups also vary significantly within sectors. However, the sectors with higher coefficients of variations are not more likely to have significant K-S test results.

4.2 In what type of sectors are heterogeneous mark-ups found?

From the previous section, we see that in over half of the sectors significant differences are found in the mark-up distributions of different types of companies. Mark-ups vary significantly also in sectors where no systematic distribution differences are found. In other words, the non-parametric test results give stronger support to the heterogeneous mark-ups assumption. However, the possible measurement biases mentioned in section 3 have not yet been accounted

for. This section continues by testing the non-parametric results with the two regression specifications presented in section 2.3. The results are reported in tables 4 and 5.

First, we regress the mark-ups' coefficient of variation (CV) on various sectoral characteristics. The results presented in table 4 show that mark-ups' variation is greater in sectors with on average more employees per company and in sectors with greater share of management level employees. The sectors with higher capital-labour ratio and higher value of stocks in equity have also greater mark-up variation. In addition, services sectors reveal greater mark-up variation than manufacturing sectors.

The large, positive effects from the share of management and from the value of stocks on the coefficient of variation suggests that there might be some measurement bias in the fixed costs as indicated in section 3. Specifically, fixed costs might be underestimated for some companies in sectors with high share of management level employees. Coefficients of variation might not provide therefore an unbiased measure on the true within sector mark-up heterogeneity. Nevertheless, this does not undermine the K-S test results. In order to test their validity, the panel probit regression results are presented in table 5.

Table 4 Regression results on variation of mark-ups

Dependant variable: Coefficient of variation (CV)	Coefficient	P-value
Number of companies	0.00	0.89
Average size of companies	0.0003	0.01
Dummy for services sectors	0.14	0.02
Concentration (Herfindahl)	-0.23	0.30
Average export share in turnover	0.00	0.10
Share of multinationals	-0.89	0.26
Capital-Labour ratio	0.09	0.00
Value of stocks in equity	0.04	0.03
Share of management	1.23	0.04
Year dummies	Yes	
R^2 within	0.16	
R^2 between	0.03	
R^2 overall	0.04	
Number of observations	348	
Number of sectors	70	
Significant results (at 5 percent confidence level) are market with italics.		

The results of the panel probit regressions report the sector characteristics that affect the probability of finding significant differences in mark-up distributions between different types of companies (table 5). Due to the low number of observations for large companies, the regression analysis on distribution differences by export status is conducted on the small companies only. The two columns in table 5 show the results on the differences between small and large

companies (i.e differences by size) and on the differences between small domestic versus small exporting companies.

Sector characteristics that affect the probability of finding significantly different mark-up distributions include the number of companies in a sector, the average capital-labour ratio and the share of management level employees. The capital-labour ratio and the average share of management level employee in particular have significant, negative coefficients. This suggests that sectors with on average higher capital-labour ratios and higher average share of management level employee are more likely to reveal insignificant differences between mark-up distributions of small and large size companies. The negative effect from the share of management indicates that the possibility for finding mark-up heterogeneity is not increased even if the (labour) fixed costs are underestimated for companies with high levels of management. On the contrary, mark-up heterogeneity might exist also in sectors with high management levels. The highly fluctuating stock changes (that affect directly the level of fixed costs in our mark-up calculations) and the average size of companies (related to small companies tax incentives in Finland mentioned earlier) are also found not to affect the possibility of finding heterogeneous mark-ups within sectors.

Table 5 Probit regressions on differences in mark-up distributions

Dependent variables: p-values of annual K-S tests	Differences by size (small vs. large)		Differences by export status * (domestic vs. exporter)	
Number of companies	0.002	(0.00)	0.001	(0.00)
Average size of companies	-0.002	(0.31)	0.000	(0.98)
Coefficient of variation	1.69	(0.10)	0,48	(0.63)
Dummy for services sectors	-0.67	(0.45)	-0.62	(0.30)
Concentration (Herfindahl)	1.75	(0.31)	-1.9	(0.23)
Average export share in turnover	-0.14	(0.93)	-1.55	(0.12)
Share of multinationals	-16.8	(0.45)	3.1	(0.91)
Capital-Labour ratio	-0.93	(0.02)	-0.30	(0.21)
Value of stocks in equity	0.61	(0.18)	-0.17	(0.67)
Share of management	-26.1	(0.01)	-4.6	(0.45)
Year dummies	Yes		Yes	
Wald chi^2, p-value	0.02		0.04	
Number of observations	343		235	
Number of sectors	69		47*	

* Result based on the K-S test result of the small size companies. P-values in brackets.
Significant results (at 5 percent confidence level) are market with italics.

The only significant sector characteristic explaining the difference in mark-up distributions between small domestic and small exporting companies is the average number of companies in the sector. The effect is, however, arbitrarily small. Therefore, the assumption of homogenous mark-ups seems to hold better when the sectors are well disaggregated or have otherwise relatively few

companies. These results reflect also the limitation of the annual K-S tests p-values in capturing significant differences at such disaggregated sector levels with low numbers of observations per year.

To summarize, the K-S tests seem to provide the most reliable estimations on the extent of mark-up heterogeneity within sectors. According to our results, mark-ups are heterogeneous in over half of the sectors studied. Only sectors with low capital-labour ratio and large amount of companies are found to have a greater possibility for mark-up heterogeneity between companies of different size. Overall, mark-up heterogeneity is not found only in some specific types of sectors, but seems like a wider phenomenon.

5. Conclusion

We contribute to the literature on company heterogeneity and mark-up pricing by analysing mark-up distributions of different types of companies within sectors. Contrary to earlier studies, we include micro-sized companies in the research and analyse the differences in the distributions between exporting and non-exporting companies covering both manufacturing and services sectors. The analysis is done with 5-year period company level data, in which we can separate variable costs and fixed costs. The database covers in practice all companies operating in Finland.

Based on our non-parametric micro-data analysis, following the approach of Delgado et al (2002), mark-ups differ significantly within various sectors. In 47 out of a total of 70 sectors, significant differences are found within the sector either between companies of different size or between companies with different export status. Smaller companies have significantly higher overall mark-ups than larger companies in nearly half of the sectors studied. Mark-ups have also relatively high coefficients of variation in various sectors. Nevertheless, there is no correlation between the general variation of mark-ups and the results of K-S tests on significant differences in the mark-up distributions of different types of companies.

The non-parametric results on mark-ups' variation and on distribution differences were regressed on various sector characteristics to control for possible measurement biases and to test in what types of sectors mark-up heterogeneity is found. According to the results, the K-S tests provide the best estimation on the heterogeneity of mark-ups. The general coefficient of variation might be affected by an underestimation of fixed costs in sectors with a high share of management level employees. Panel probit regressions on the K-S test results show that share of management level employees and capital-labour ratio have a negative effect on the probability for finding significant mark-up heterogeneity. A higher number of companies in a sector increase also the probability for mark-up heterogeneity, but the effect is minimal.

In general, mark-ups are significantly heterogeneous in various sectors even at NACE 2-3 digit levels. This mark-up heterogeneity is not prevalent only in few specific types of sectors, but a widespread phenomenon. As Finland is a country with relatively high export participation rate, open trade policies, high GDP per capita and effective regulatory system, this mark-up heterogeneity found should be considered a minimum level to be expected. Mark-up heterogeneity in developing countries is expected to be significantly higher. Therefore, additional research on mark-up heterogeneity within sectors is recommended with other methodologies and with data from less developed countries. Cautiousness is

recalled with regards to policy suggestions derived from theoretical models with a homogeneous mark-up assumption.

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Annex 1: Identification of exporters

The YRTTI-data includes the value of goods exports and imports of each company to and from other EU-countries in addition to accounting for other VAT free sales that do not fall under the Finnish VAT obligation. The VAT free sales include: exports to non-EU countries, all exports of services, sales of ordered newspapers, sales of water transportation services and changes in stocks of a few other products (affects mostly wholesale and retailers)[19]. Accordingly, when we exclude the data for water transportation, newspaper, wholesale and retailer services sectors, we have information on the status of the company's services and goods exports for some services sectors. However, the selling/consumption based rules on VAT obligation in services trade need to be acknowledged as well (Finnish tax authorities, 2009). Table A1.1 presents the final list of services sectors where each company's exporting status can be identified from the VAT records. VAT records were also used by Borchsenius et al (2010) for the identification of services exporters.

In general, the VAT free sales can include exports of GATS trade in services modes 1, 3 and 4[20], while mode 2 services are mostly taxed in Finland and therefore VAT free sales do not account for them (Finnish tax authorities, 2009). As a result, the identification of services exporters can be slightly underestimated. As mode 2 trade in services takes place in the reporting country, where the buyer arrives, it could be considered that companies involved only in mode 2 of services trade are not extremely different from domestic companies.

In order to check the coverage of exporters identified with the VAT records compared to the official trade statistics, table A1.2 shows the value of exports and imports of goods to all EU countries from Finland and the value of all services exports. They were calculated by the sum of all company specific values in the whole sample between year 2005 and 2009 and within the restricted sample that includes only companies with more than 3 employees. The totals have been compared to the official statistics on the Finnish intra-EU export/import flows (from Eurostat) and to the value of all services exports from Finland excluding construction services exports (from Statistics Finland). While the goods exports and imports to EU countries match the official statistics very well, the services exports flows cover at most 70% of the official statistics. This is due to the possibility of identifying services exporters only in some sectors from the VAT records.

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19 Finnish tax authority, VAT reporting directions:
http://portal.vero.fi/public/default.aspx?uielementsize=2&nodeid=7966#309

20 The General Agreement on Trade in Services (GATS) of WTO classifies 4 main modes for trading in services: Mode 1 = cross-border supply, Mode 2 = consumption abroad, Mode 3 = commercial presence and Mode 4 = presence of natural persons. Source:
http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm6_e.htm

Table A1.1 Services sectors in which exporters could be identified and statistics from year 2009

Sector code	Industry	Number of companies	Exporting companies in the sector, %	Share of all services exporters identified, %	Share of total services exports value, %
62	Air transport	16	75	0.2	24.9[21]
65	Financial services	209	29	2.8	10.7
66	Insurance services	2	18	0.0	2.0
71	Renting of machinery and equipment	172	31	2.3	0.9
72	Computer and related services	1,175	42	16.0	14.5
73	Research and development	136	55	1.9	2.7
90	Environmental services	56	15	0.8	0.2
527	Repair of household goods	56	22	0.8	0.0
633	Other transport and travel services	299	39	4.1	11.2
641	Post and courier activities	24	22	0.3	4.8
642	Telecommunications	81	31	1.1	3.2
672	Activities auxiliary to financial intermediation	160	28	2.2	1.6
673	Activities auxiliary to insurance services	22	17	0.3	0.1
741	Legal, accounting, business services	1,914	29	26.1	6.0
742	Architectural and engineering serv.	939	31	12.8	11.4
743	Technical testing services	93	47	1.3	0.8
744	Advertising services	451	37	6.1	1.1
745	Job agencies	143	21	1.9	0.3
746	Security services	34	13	0.5	0.0
747	Cleaning services	120	10	1.6	0.5
748	Other business services	838	36	11.4	2.3
9214	Entertainment and news services	406	36	5.5	0.8
	Total	7,346		100.00	100.00

Companies, for which trade data was available from the VAT records, were classified as exporters, importers or domestic companies according to the rules presented in table A1.3. No minimum share of exports on turnover was set for the classification. As Figure A1.1 shows, both in the manufacturing and in the services sectors the share of exports on turnover is relatively small for the majority of companies. Within the services sectors the shares are even lower than in the manufacturing sectors. This means that any minimum level requirement on the share of exports on turnover would drop a significant number of the exporter observations by default. Around 22% of exporting manufactures and 21% of

[21] The share of air transportation in services exports is overestimated in the data. All foreign flights operated by Finnish airlines are VAT free (only domestic flights include VAT), no matter whether the passengers are Finnish or foreign. By the WTO definition of trade in services (WTO, 2010) only the air travel services operated by Finnish companies to foreign passengers should be included in the official calculation of trade in services.

services exporters report export sales that contribute to less than 1% of their total sales. Nevertheless, the share of exporters that export large percentage of their total turnover is rather high in Finland in comparison to other countries. For around 60% of goods exporters the total value of exports is over 5% of turnover. Only around 40% of exporters in Germany and France enjoy this level of exports to turnover (Mayer and Ottaviano, 2008).

Table A1.2 Value of exports and share of the total value reported in official statistics, years 2005-2009

		2005	2006	2007	2008	2009
All companies						
Value, in billion €	EU imports, goods	31.0	34.0	36.5	37.7	28.3
	EU exports, goods	29.3	34.4	36.4	36.0	24.4
	All services exports	5.8	6.5	6.9	7.2	6.3
Share of official records, %	EU imports, goods	98	96	96	97	100
	EU exports, goods	98	98	98	98	97
	All services exports	63	70	59	46	44
Only companies with minimum 4 employees						
Value, in billion €	EU imports, goods	26.9	28.6	30.7	31.3	24.1
	EU exports, goods	26.1	31.7	33.8	33.5	20.7
	All services exports	5.2	5.6	6.4	6.6	5.8
Share of official records, %	EU imports, goods	85	81	80	81	85
	EU exports, goods	87	90	91	91	83
	All services exports	57	60	55	43	40

Figure A1.1 Share of exports in turnover, averages over 2005-2009, exporters in manufacturing sectors vs. services sectors

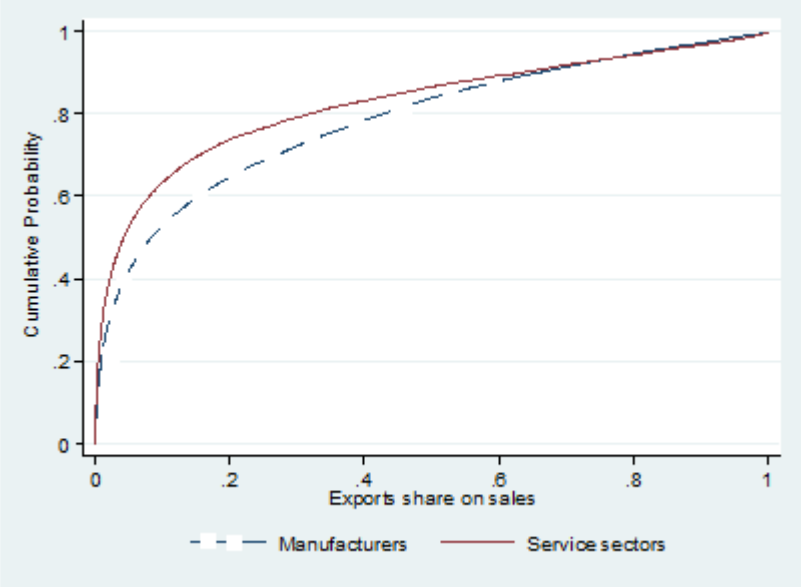

Table A1.3 Classification rules for determining the export status of each company

	Goods sales to EU	Goods imports from EU	VAT free sales	Multinational (offices abroad, foreign company or foreign affiliate)	Classification in aggregated groups
Manufacturing companies					
Domestic					
1.National	€0 or value missing	€0 or value missing	€0 or value missing	Not a multinational	1. Domestic
2.EU importer	€0 or value missing	>€0	€0 or value missing	Not a multinational	1. Domestic (if only 2 groups) or 3. Importer
Exporter					
EU exporter					
3.EU exporter	>€0	€0 or value missing	€0 or value missing	Can be multinational	2. Exporter/Multinational
4.EU exporter and importer	>€0	>€0	€0 or value missing	Can be multinational	2. Exporter/Multinational
5.Non-EU exporter	€0 or value missing	€0 or value missing	>€0 and company manufacturer	Can be multinational	2. Exporter/Multinational
Services sector companies					
Domestic					
1.National	€0 or value missing	€0 or value missing	€0 or value missing	Not a multinational	1. Domestic
2.EU (goods) importer	€0 or value missing	>€0	€0 or value missing	Not a multinational	1.Domestic (if only 2 groups) or 3. Importer
6. Services exporter	€0 or > €0	€0 or > €0	>€0 and company among the 22 service sectors, see table A1.1.	Can be multinational	2. Exporter/Multinational

Annex 2. Industry specific results

Table A2.1 Industry specific mark-up estimates and differences in salary levels and productivity by company type

Sector code	Sector	No. of obs. (all 5 years)	Mark-up, mean	Mark-up, s.d.	Mark-up, CV	Fixed costs over VC, mean	Profit over VC, mean	Significant differences in average salary levels[1]	Significant differences in value added per employee[1]	Mean, mark-up (sub-sample[2])	Mean, sector mark-up, another study [3]
1	Agricultural production	1,945	0.64	0.61	0.94	0.56	0.08	Yes, for L&X	Yes, for X	0.54	
2	Forestry and logging	3,107	1.11	0.87	0.78	0.96	0.15	Yes, for X	No	0.72	
5	Fishing and fish farming	101	0.52	0.54	1.05	0.50	0.02	No	Yes, for X	0.51	
20	Manufacture of wood and wood products	3,717	0.38	0.40	1.04	0.41	-0.02	Yes, for L&X	Yes, for L&X	0.29	
22	Publishing and printing	4,759	0.56	0.51	0.90	0.54	0.02	Yes, for L&X	Yes, for L&X	0.49	
23	Manufacture of coke and refined petroleum	21	0.58	0.38	0.65	0.54	0.04	n.a	n.a	0.48	
24	Manufacture of chemicals	820	0.55	0.56	1.02	0.58	-0.04	Yes, for L&X	Yes, for L&X	0.52	
25	Manufacture of rubber and plastic	1,640	0.45	0.39	0.87	0.39	0.07	Yes, for L	Yes, for L&X	0.37	
26	Manufacture of glass and ceramic	1,586	0.51	0.41	0.82	0.43	0.08	Yes, for L&X	Yes, for L&X	0.40	
28	Manufacture of metal products	9,629	0.48	0.38	0.79	0.40	0.09	Yes, for L&X	Yes, for L&X	0.38	
29	Manufacture of machinery	4,912	0.45	0.40	0.88	0.37	0.09	Yes, for L&X	Yes, for L&X	0.36	
32	Manufacture of electronics	918	0.40	0.42	1.06	0.44	-0.05	Yes, for X	Yes, for L&X	0.36	
33	Manuf. of medical, testing and optical equipment	1,709	0.48	0.41	0.85	0.44	0.04	Yes, for L&X	Yes, for L&X	0.43	
37	Recycling of metal and non-metal waste	103	0.65	0.49	0.76	0.48	0.17	Yes, for L	Yes, for L	0.47	
41	Distribution of water	341	1.15	0.91	0.79	1.25	-0.09	No	No	0.75	
51	Wholesale trade and commission trade	21,765	0.39	0.47	1.21	0.35	0.05	Yes, for L	Yes, for L	0.33	0.32
61	Water transport	563	0.94	0.87	0.93	0.86	0.09	Yes, for L	Yes, for L	0.75	1.01
62	Air transport	77	1.18	1.16	0.99	1.23	-0.05	No	Yes, for L	0.59	
65	Financial services	888	1.19	1.31	1.10	1.07	0.12	Yes, for X	Yes, for L	0.80	0.68
66	Insurance services	17	2.06	2.17	1.05	1.87	0.19	No	No	0.60	
71	Renting of machinery and equipment	1,270	1.00	0.90	0.91	0.89	0.11	Yes, for X	Yes, for L&X	0.82	0.77

Sector code	Sector	No. of obs. (all 5 years)	Mark -up, mean	Mark -up, s.d.	Mark -up, CV	Fixed costs over VC, mean	Profit over VC, mean	Significant differences in average salary levels[1]	Significant differences in value added per employee[1]	Mean, mark-up (sub-sample[2])	Mean, sector mark-up, another study [3]
72	Computer and related services	7,172	0.64	0.59	0.92	0.62	0.02	Yes, for L&X	Yes, for L&X	0.61	0.43
73	Research and development	552	0.69	0.93	1.36	1.00	-0.32	Yes, for X	Yes, for L	0.58	
80	Education	2,160	0.94	0.68	0.72	0.80	0.14	No	No	0.70	1.57
90	Environmental services	1,245	0.86	0.69	0.80	0.74	0.13	Yes, for X	Yes, for L&X	0.83	
103	Extraction and agglomeration of peat	603	1.16	0.95	0.82	0.96	0.19	Yes, for L	Yes, for L&X	0.95	
134	Mining of non-ferrous metals	544	0.82	0.79	0.97	0.73	0.09	Yes, for X	Yes, for L	0.57	
156	Manufacture of food products and beverages	3,754	0.46	0.36	0.78	0.41	0.05	Yes, for L&X	Yes, for L&X	0.43	
179	Manuf. of textiles, wearing apparel and shoes	1,893	0.43	0.32	0.75	0.39	0.04	Yes, for L&X	Yes, for L&X	0.40	
212	Manufacture of paper and paperboard	348	0.41	0.26	0.63	0.38	0.03	Yes, for L&X	Yes, for L&X	0.37	
271	Manufacture of iron and steel	81	0.49	0.59	1.19	0.44	0.05	No	Yes, for X	0.45	
301	Manufacture of office and electrical equipment	773	0.38	0.36	0.96	0.31	0.06	Yes, for L&X	Yes, for L&X	0.32	
345	Manuf. of cars and other transport equipment	1,480	0.38	0.38	1.02	0.32	0.05	Yes, for L&X	Yes, for L&X	0.29	
361	Manufacture of furniture	1,795	0.40	0.31	0.77	0.35	0.05	Yes, for L&X	Yes, for L&X	0.36	
501	Sale of motor vehicles	1,994	0.19	0.42	2.20	0.18	0.01	Yes, for L	Yes, for L	0.11	
502	Maintenance and repair of motor vehicles	9,568	0.33	0.32	0.98	0.27	0.06	Yes, for L	Yes, for L	0.28	
521	Retail sale	24,236	0.34	0.36	1.07	0.30	0.04	No	Yes, for L	0.29	
527	Repair of household goods	733	0.46	0.32	0.70	0.36	0.09	Yes, for X	No	0.37	
551	Hotels	2,519	1.05	0.81	0.78	1.00	0.04	Yes, for L	Yes, for L	0.88	
553	Restaurants	14,883	0.53	0.35	0.66	0.48	0.05	Yes, for L	No	0.53	
601	Transport via railways	22	0.76	0.80	1.05	0.56	0.20	No	No	0.87	0.77
633	Other transport and travel services	1,519	0.60	0.71	1.18	0.62	-0.02	Yes, for L&X	Yes, for L&X	0.44	0.55
641	Post and courier activities	427	0.70	0.55	0.79	0.59	0.11	Yes, for L	Yes, for S&X	0.52	
642	Telecommunications	709	0.76	0.79	1.04	0.71	0.05	Yes, for X	Yes, for L&X	0.71	
671	Activities auxiliary to financial intermediation	787	1.03	1.13	1.10	1.08	-0.05	No	No	0.83	0.62
672	Activities auxiliary to insurance services	125	0.93	0.74	0.79	0.88	0.05	No	No	0.74	
741	Legal, accounting, book-keeping and auditing services	10,958	0.93	0.76	0.82	0.73	0.20	Yes, for L&X	Yes, for L&X	0.71	0.98
742	Architectural and engineering activities	9,003	0.63	0.49	0.78	0.50	0.13	Yes, for L&X	Yes, for L&X	0.49	0.67
743	Technical testing and analysis services	647	0.98	0.71	0.73	0.75	0.23	Yes, for X	Yes, for X	0.89	
744	Advertising services	2,953	0.60	0.47	0.79	0.54	0.06	Yes, for L&X	Yes, for S&X	0.51	
745	Job agencies and personnel recruitment	2,342	0.43	0.48	1.11	0.39	0.04	Yes, for L	Yes, for S&X	0.35	

Sector code	Sector	No. of obs. (all 5 years)	Mark -up, mean	Mark -up, s.d.	Mark -up, CV	Fixed costs over VC, mean	Profit over VC, mean	Significant differences in average salary levels[1]	Significant differences in value added per employee[1]	Mean, mark-up (sub-sample[2])	Mean, sector mark-up, another study [3]
746	Security services	673	0.62	0.59	0.96	0.67	-0.04	No	Yes, for X	0.49	
747	Cleaning services	2,882	0.72	0.67	0.93	0.51	0.21	Yes, for L	Yes, for S	0.45	
748	Other business services	4,120	0.76	0.73	0.96	0.68	0.08	Yes, for L&X	Yes, for S&X	0.61	
851	Human health services	1,554	0.85	0.66	0.79	0.71	0.13	Yes, for L	Yes, for S	0.63	
853	Social work services	1,041	0.66	0.57	0.86	0.59	0.07	No	No	0.55	
2725	Manufacture of processed iron and steel	302	0.42	0.27	0.65	0.34	0.08	Yes, for L&X	Yes, for L	0.38	
3626	Manuf. of jewellery, music instruments and toys	646	0.50	0.47	0.95	0.44	0.06	Yes, for L&X	Yes, for L&X	0.44	
4013	Distribution of electricity and gas	906	0.63	0.72	1.15	0.56	0.06	Yes, for L&X	Yes, for L&X	0.51	0.93
4501	Construction of buildings	5,700	0.85	0.71	0.83	0.74	0.11	Yes, for L	Yes, for L	0.54	
4502	Civil engineering	21,724	0.46	0.45	0.98	0.38	0.08	Yes, for L	Yes, for L	0.31	0.33
4509	Construction service activities	17,552	0.44	0.38	0.86	0.35	0.09	Yes, for L	Yes, for L	0.35	0.33
6023	Road transportation services	20,596	0.88	0.82	0.93	0.76	0.13	No	Yes, for S	0.57	
7012	Real estate activities	1,197	1.21	1.24	1.03	1.07	0.13	No	Yes, for L	0.65	
7031	Real estate agencies	1,755	1.02	0.68	0.67	0.92	0.09	No	No	0.82	
7032	Management of real estate	4,642	0.76	0.58	0.77	0.61	0.14	Yes, for L	Yes, for S	0.55	
9214	Entertainment and news services	1,992	0.87	0.82	0,94	0.82	0.06	Yes, for L&X	Yes, for S&X	0.67	
9267	Sports and other recreational services	3,065	1.16	0.87	0.75	1.20	-0.04	Yes, for L	Yes, for L	1.03	
21121	Manufacture of pulp, paper and paperboard	233	0.47	0.38	0.83	0.46	0.01	No	Yes, for L&X	0.39	
63019	Road, track and air transport service activities	2,996	0.70	0.79	1.14	0.63	0.07	No	No	0.53	
Total		Mean	0.70	0.62	0,92	0.63	0.06			0.55	
		Sd	0.30	0.30	0,22	0.29	0.08			0.20	

Notes: * CV = Coefficient of variation

[1] Significant differences found between companies of different size or between companies with different exporting status at 5% significance level, where the higher values are obtained for : S=small, L=large, D=domestic or X=exporting company category. N.a indicates when comparison is not possible.

[2] This subsample consists of companies with minimum of 20 employees and above for ease of comparison with the Molnar and Bottini (2008) sample.

[3] Results of Molnar and Bottini (2008) for Finland. Their sample includes only companies with minimum 20 employees and in the education sector only private companies.

Table A2.2 Differences in mark-up distributions between different types of companies

	All samples					Small companies					Large companies				
	Small		Large		P-value*	Domestic		Exporter		P-value*	Domestic		Exporter		P-value*
Sector code	Average mark-up	Obs.	Average mark-up	Obs.	small vs. large	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter
1	0.65	1866	0.47	79	0.20	0.66	1510	0.63	356	0.39	0.46	41	0.47	38	0.86
2	1.12	3030	0.61	77	0.01	1.13	2667	1.02	363	0.01	0.69	45	0.50	32	0.15
5	n.a	n.a	n.a	n.a	n.a	0.58	51	0.45	49	0.25	n.a	n.a	0.46	1	n.a
20	0.40	3227	0.29	490	0.00	0.44	1965	0.33	1262	0.00	0.27	76	0.30	414	0.14
22	0.58	4016	0.48	743	0.00	0.65	1503	0.54	2513	0.00	0.53	111	0.48	632	0.39
23	0.72	14	0.30	7	0.56	1.33	1	0.68	13	n.a	n.a	n.a	0.30	7	n.a
24	0.53	557	0.59	263	0.13	0.56	149	0.51	408	0.38	0.58	4	0.59	259	0.87
25	0.47	1238	0.39	402	0.00	0.55	376	0.44	862	0.00	0.32	12	0.39	390	0.12
26	0.53	1251	0.41	335	0.00	0.52	800	0.56	451	0.08	0.31	79	0.44	256	0.08
28	0.50	8581	0.34	1048	0.00	0.53	5417	0.45	3164	0.00	0.38	117	0.33	931	0.02
29	0.48	4041	0.35	871	0.00	0.54	1988	0.41	2053	0.00	0.32	46	0.35	825	0.40
32	0.41	676	0.36	242	0.05	0.44	193	0.40	483	0.30	0.32	3	0.36	239	0.69
33	0.50	1436	0.43	273	0.00	0.55	480	0.47	956	0.00	0.67	5	0.42	268	0.28
37	0.68	97	0.16	6	0.32	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
41	1.17	327	0.69	14	0.51	1.20	301	0.91	26	0.53	0.64	9	0.79	5	0.39
51	0.39	19980	0.36	1785	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
61	0.89	429	1.13	134	0.01	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
62	1.50	52	0.52	25	0.26	1.34	14	1.56	38	0.61	0.48	6	0.54	19	0.46
65	1.17	792	1.37	96	0.17	1.18	585	1.13	207	0.60	1.14	41	1.54	55	0.15
66	1.74	12	2.81	5	0.78	1.74	12	n.a	n.a	n.a	2.81	5	n.a	n.a	n.a
71	0.99	1184	1.06	86	0.46	0.97	840	1.04	344	0.29	0.86	39	1.23	47	0.96
72	0.64	6464	0.64	708	0.93	0.64	3933	0.64	2531	0.88	0.58	243	0.67	465	0.02
73	0.70	470	0.59	82	0.27	0.80	224	0.62	246	0.05	0.94	19	0.49	63	0.76
80	0.96	1993	0.75	167	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
90	0.87	1163	0.79	82	0.16	0.87	1008	0.84	155	0.58	0.80	53	0.78	29	0.83
103	1.16	595	0.87	8	0.77	1.17	552	1.08	43	0.48	n.a	n.a	0.87	8	n.a
134	0.83	496	0.67	48	0.51	0.91	381	0.57	115	0.00	0.98	15	0.53	33	0.11
156	0.46	3138	0.46	616	0.95	0.47	2345	0.44	793	0.07	0.50	188	0.44	428	0.10

	All samples					Small companies					Large companies				
	Small		Large		P-value*	Domestic		Exporter		P-value*	Domestic		Exporter		P-value*
Sector code	Average mark-up	Obs.	Average mark-up	Obs.	small vs. large	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter
179	0.43	1659	0.41	234	0.37	0.49	660	0.39	999	0.00	0.47	23	0.41	211	0.35
212	0.44	259	0.33	89	0.29	0.49	84	0.42	175	0.11	0.43	2	0.33	87	0.11
271	0.51	45	0.47	36	0.70	0.62	30	0.29	15	0.79	1.74	2	0.39	34	0.20
301	0.39	597	0.34	176	0.22	0.38	254	0.39	343	0.59	0.30	11	0.35	165	0.25
345	0.41	1189	0.26	291	0.00	0.43	439	0.39	750	0.20	0.24	14	0.26	277	0.60
361	0.40	1598	0.37	197	0.25	0.41	931	0.39	667	0.41	0.63	10	0.36	187	0.23
501	0.20	1684	0.12	310	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
502	0.33	9270	0.27	298	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
521	0.34	22645	0.31	1591	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
527	0.46	724	0.29	9	0.41	0.48	570	0.38	154	0.00	0.18	1	0.30	8	n.a
551	1.04	2158	1.08	361	0.37	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
553	0.53	14159	0.54	724	0.43	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
601	0.53	15	1.24	7	0.72	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
633	0.61	1368	0.50	151	0.02	0.71	842	0.46	526	0.00	0.47	82	0.53	69	0.58
641	0.80	292	0.47	135	0.00	0.87	223	0.59	69	0.25	0.49	112	0.42	23	0.09
642	0.72	501	0.85	208	0.04	0.76	361	0.61	140	0.06	0.91	122	0.76	86	0.10
671	1.03	749	1.09	38	0.63	1.10	541	0.83	208	0.00	1.01	29	1.33	9	0.61
672	1.00	95	0.72	30	0.48	1.02	74	0.92	21	0.47	0.72	30	n.a	n.a	n.a
741	0.93	10354	0.83	604	0.00	0.94	7521	0.92	2833	0.19	0.84	229	0.82	375	0.87
742	0.64	8346	0.49	657	0.00	0.67	5995	0.56	2351	0.00	0.51	201	0.48	456	0.52
743	0.98	607	0.97	40	0.52	1.04	330	0.90	277	0.02	1.52	13	0.71	27	0.89
744	0.61	2696	0.49	257	0.00	0.64	1763	0.55	933	0.00	0.53	119	0.46	138	0.07
745	0.55	1094	0.32	1248	0.00	0.53	869	0.62	225	0.07	0.31	980	0.35	268	0.10
746	0.65	560	0.47	113	0.00	0.66	491	0.60	69	0.45	0.47	95	0.50	18	0.62
747	0.76	2570	0.39	312	0.00	0.76	2348	0.66	222	0.01	0.39	247	0.39	65	0.96
748	0.78	3611	0.63	509	0.00	0.81	2329	0.72	1282	0.00	0.57	308	0.70	201	0.02
851	0.89	1341	0.59	213	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
853	0.68	893	0.52	148	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
2725	0.42	217	0.43	85	0.86	0.50	93	0.36	124	0.00	0.94	6	0.39	79	0.07
3626	0.50	583	0.51	63	0.16	0.66	165	0.44	418	0.00	0.49	6	0.51	57	0.81
4013	0.59	694	0.73	212	0.04	0.59	596	0.59	98	0.91	0.72	165	0.76	47	0.74

	All samples					Small companies					Large companies				
	Small		Large		P-value*	Domestic		Exporter		P-value*	Domestic		Exporter		P-value*
Sector code	Average mark-up	Obs.	Average mark-up	Obs.	small vs. large	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter	Average mark-up	Obs.	Average mark-up	Obs.	domestic vs. exporter
4501	0.87	5503	0.40	197	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
4502	0.47	20578	0.28	1146	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
4509	0.45	16769	0.34	783	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
6023	0.90	19808	0.48	788	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
7012	1.19	1102	1.40	95	0.20	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
7031	1.02	1723	0.98	32	0.45	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
7032	0.77	4321	0.49	321	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
9214	0.90	1710	0.72	282	0.00	0.92	1089	0.87	621	0.20	0.74	163	0.70	119	0.60
9267	1.17	2814	1.01	251	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
21121	0.53	125	0.39	108	0.00	0.56	54	0.51	71	0.51	0.62	4	0.38	104	0.29
63019	0.73	2525	0.53	471	0.00	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a

* P-value on the difference of the distributions based on average annual K-S test value or Welsh's t-test (if high number of observations).

⊙ "n.r" stands for not reported due to very low number of observations; "n.a" stands for not available

Annex 3. Descriptive statistics of variables included in the regression analyses

Descriptive statistics for regression variables[1], averages and standard deviations over all sectors

	Mean	Standard deviation	Min	Max
Coefficient of variation	0.91	0.24	0.08	2.26
Number of companies	751	1,125	2	5,050
Average size of companies in terms of employees	108	256	9	2,067
Concentration (Herfindahl)	0.16	0.25	0.00	0.97
Average export share in turnover[2]	0.10	0.14	0.00	1.0
Share of multinationals	0.01	0.03	0.00	0.35
Capital-Labour ratio [3]	8.9	1.1	5.1	12.3
Share of management	0.08	0.05	0.01	0.21
Value of stocks in equity[2]	0.55	0.42	0.00	1.0
Number of Services sectors is 47. Total number of sectors is 70.				

[1] See section 3 for explanations of the variables.

[2] The sector averages are calculated without the first and last percentile of outlier observations (see section 3 on data).

[3] Measured as the log of capital value per employee.

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